Summary of Topics for Bioengineering/Physiology 6000
System Physiology I
Mid Term #2, 2014 Edition, April 9

Rob MacLeod (macleod@sci.utah.edu)

April 5, 2014

Forward

The following is a list of topics that we covered in the second part of the semester in Bioengineering 6000 course. I expect students to be familiar with each of the concepts and ideas and will draw from this list for first midterm questions.

1 Cardiac Mechanics

1.1 Cellular

1. Excitation-Contraction coupling:
   - Sequence of events in EC coupling,
   - Calcium induced calcium release theory,
   - Regulation of contraction.

1.2 Whole Heart

1. Effect of preload, pretension, Frank-Starling effect,
2. Effect of afterload on contraction,
3. Cardiac Cycle, pressure-volume, and cardiac function curves (Wigger's diagram), and
4. Control mechanisms for heart rate and contractility.

2 Hemodynamics

1. Limitations of applying classical fluid dynamics to blood,
2. Hemodynamic parameters and what they mean,
3. Effects and mechanisms of stenosis on blood flow and pressure,

4. Poiseuille's Law, resistance, and viscosity of blood, and
5. Area-resistance paradox in the resistance vessels (arterioles) of the arterial system.

3 The circulatory system

1. Roles and functions of the circulatory system,
2. Open versus closed cardiovascular systems,
3. Role of blood, and
4. Control of red blood cell production.
5. Arterial and Venous systems
    - Distribution throughout the circulatory system of blood volume, flow, pressure, vessel resistance,
    - Role of the arterial system as compliant vessel, hydraulic filter,
    - Definitions of resistance and compliance,
    - Response of the arterial system to variations in compliance, resistance, and cardiac output,
    - Structure and role of venous systems, valves, and
    - Measurement of blood pressure and flow.
6. Microcirculation:
    - Structure of the microcirculation,
    - Types of capillaries, and features of interstitial space,
    - Structure and role of lymphatics,
    - Capillary diffusion, and
    - Water balance and pulmonary edema.
7. Control of circulation
    - Local control of blood flow,
        - Local control: myogenic and metabolic mechanisms,
        - Central control,
    - Control of blood pressure,
    - Baroreceptor mechanism, and
    - Response of circulation to exercise

4 Background materials from the text

The following pointers are to sections in the Eckert Animal Physiology text that are recommended or required reading:

Chapter 12: pages 473–476, 481–486, 495–511 (up to the section on The Immune Response), 512–522

For other resources should you need more explanation please see here
`http://www.sci.utah.edu/~macleod/bioen/be6000/background.html`